Rec'd PCT/PTO 14 SEP 2005

10/520304

Device for supplying electrical energy to a sensor which is at a high electrical voltage in a painting system

The invention relates to device for supplying electrical energy to a sensor which is at a high electrical voltage in a painting system.

In modern painting systems, increased use is being made of applicator devices which employ a high-voltage electrode to ionise the paint being sprayed by them, so that it is drawn by electrostatic forces onto the objects to be coated, which are generally at the earth potential. In such painting systems, there is often a need for sensors which are at the same high electrical potential as the applicator device itself. An example of such a sensor is a detector which establishes whether a shuttle responsible for transporting the paint to the applicator device is present in the shuttle station next to the applicator device. These sensors, which in general operate electrically, require an electrical power supply. This, however, presents difficulties owing to the high potential of the sensors.

In known painting systems with electrical sensors which are at a high potential, the latter are supplied from batteries. These, however, have only a short service life so that the operation of the painting system has to be interrupted frequently in order to replace the batteries.

It is an object of the present invention to provide a device of the type mentioned in the introduction, with which the painting system can be operated for a long time without interruption for maintenance.

This object is achieved according to the invention in that the device comprises:

a) a light source which is at a low electrical potential, in particular the earth potential;

b) a light receiver in which a converter converting light energy into electrical energy is provided, which is electrically connected to the sensor and is at the high potential of the sensor;

c) an optical waveguide which connects the light source to the light receiver.

According to the invention, the energy source from which the sensor is supplied is thus a light source which - since it is DC isolated from the components carrying high voltage - can be at a low potential. In the light receiver, the light which has been delivered is converted back into electrical energy which can be used to operate the sensor.

The converter is expediently a solar cell; such solar cells are now available inexpensively and have a comparatively good electrical efficiency.

The optical waveguide may be formed by a bundle of optical fibres. In this way, it also has a high efficiency.

The use of optical waveguides which are formed by a bundle of optical fibres makes it possible to employ a configuration of the invention in which the light receiver has a housing in which is a transparent plate, into which the ends of the fibres of the optical waveguide are fed, is arranged in the vicinity of a side wall, all the internal surfaces of the housing which the light emerging

from the transparent plate can reach being provided with a reflective layer. This configuration of the invention makes do without imaging elements. A flat light source is produced with the aid of the individual fibres of the optical waveguide and the transparent plate, into which the fibre ends are fitted. The light emerging from it is reflected by the reflective inner walls of the housing of the light receiver until it finally reaches the solar cell and is converted into electrical energy.

The transparent plate is expediently a plastic plate, which can be readily processed mechanically in order to receive the fibre ends.

For reasons of cost, it is recommendable for the reflective layer on the inner walls of the housing of the light receiver to consist of aluminium foil.

Alternatively, the light receiver may contain a converging lens by which the light emerging from the end face of the optical waveguide is essentially collimated and thus guided onto the converter. In this case as well, the converter is illuminated extensively and substantially homogeneously with light, which improves the conversion efficiency.

A more particularly preferred embodiment of the invention is one in which an accumulator is provided, which is constantly charged by the voltage being generated by the converter. The sensor is thus supplied only indirectly from the electrical energy which is generated by the converter, that is to say via the energy-storing accumulator. This makes it possible to achieve more consistent operating conditions for the sensor; the

accumulator is virtually always fully charged so that it has a very long life.

The invention will be explained in more detail below with reference to the drawing. The single figure schematically shows a device for supplying a sensor of a painting system, which is at a high electrical potential.

The main components of the device as represented are a light source 1, which is connected to a light receiver 2 via an optical waveguide 4 made up of individual optical fibres. The light receiver 2 has a housing 5, in which a transparent or optionally translucent plastic plate 6 is fitted parallel to the side face through which the optical waveguide 4 passes. The plastic plate 6 extends over the entire cross section of the housing 5. The ends of the fibres of the optical waveguide 4 are spread apart and fastened in the transparent plate 6 with a distribution which is as uniform as possible.

Opposite the transparent plate 6 and likewise next to a side face of the housing 5, the housing 5 contains a solar cell 3 used as an electrical converter. The solar cell 3 also extends over the entire cross section of the housing 5. The inner walls of the housing 5 between the transparent plate 6 and the solar cell 3 are covered with reflective aluminium foil 7.

An accumulator 8 and a charging circuit (not shown in the drawing) are arranged in the space between the solar cell 3 and the side face of the housing 5 adjacent to the solar cell 3. The charging circuit is supplied with the output voltage of the solar cell 3; it converts this output voltage in known fashion, and constantly charges the accumulator 8 so that it is always approximately fully

charged. The accumulator 8 is in turn connected to the sensor (not shown in the drawing) via a cable 9.

Owing to the DC connection via the cable 9, the light receiver 2 is at the same high electrical potential as the sensor; the light source 1 is at the earth potential.

The device as described above functions in the following way:

Through the optical waveguide 4, the light source 1 operated with electrical energy transmits light which is spread out to form a flat light source using the individual optical fibres and the plastic plate 6. After a variable number of reflections, the light radiated by this flat light source reaches the solar cell 3 which converts the light into electrical energy. This is used by the charging circuit in order to recharge the accumulator 8. The electrical energy drawn off via the cable 9 in order to supply the sensor is thus continuously replaced in the accumulator 8 by the electrical energy obtained from the light of the light source 1. Since the accumulator 8 is constantly fully charged, its service life is extraordinary long. The device can therefore be operated for a very long time without having to carry out maintenance work on the electrical power supply of the sensor.